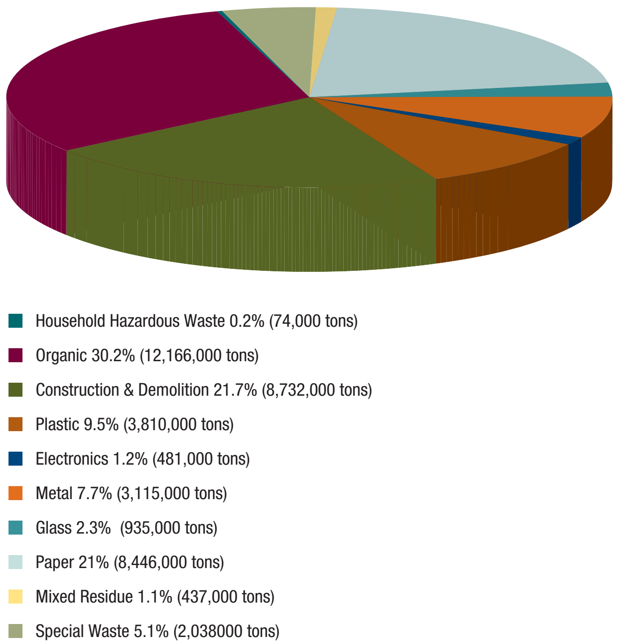
Solid Waste

THE CHALLENGE

Between 1995 and 2005, our region disposed of approximately 33 million tons of municipal solid waste (MSW) i.e., garbage, into local landfills each year.[1] The average resident disposes of approximately 2.5 pounds of trash a day[2] while non-residential disposal adds up to 1.2 pounds disposed for every $10 of sales receipts.[3] The California waste stream is primarily composed of organic (food) waste, paper products, and construction and demolition debris. Harder-to-decompose items such as plastic, glass, metal, electronic, and hazardous wastes are also present in the waste stream in significant amounts (see **Figure 7.1**). Although we have made great strides in reducing per capita generation–in 1990, residential disposal was estimated at 3.1 pounds per day, existing landfills and potentially future landfills will not be enough to accommodate our growing population and economy. Therefore, it is imperative that the region work together to develop better waste management strategies.

FIGURE 7.1



Traditional solid waste management has relied heavily on creating high capacity, relatively local landfills (megafills) and, to a lesser extent in California, incineration technologies (such as direct combustion or combustion with energy recovery) to address disposal issues. However, due to significant public opposition, unavailability of suitable land, environmental concerns, and the regulatory framework, it has become increasingly difficult to expand and/or site, permit, and operate new landfills and waste-to-energy (incineration) facilities. Federal, State, and local zoning regulations restrict the number of sites suitable for development. Some restrictions on land use include

Overflowing landfills are a symptom of a bigger

WHEN LANDFILLS CLOSE

Although landfills employ extensive environmental control systems, concerns have been raised about post-closure operations and whether landfill operators are capable of maintaining landfill facilities until the waste no longer poses a risk to public health, safety, and the environment.

Post-closure care of landfills will require decision-makers, the waste industry, environmental organizations, and other stakeholders to continue working together towards developing an adequate solution.

areas with unstable soils and terrain, landslide-susceptibility, fault areas, seismic impact zones, land near airports, and land in 100 year flood plains. Potential landfill sites must also consider migration control of leachate and methane, soil type to provide a firm foundation, hydrologic settings that will affect landfill layout and drainage characteristics, and a host of other factors. In addition, local public opinion plays a big role in landfill siting discussions.[4, 5]

Dwindling landfill capacity near urban centers, increasing health and environmental concerns, and public policy goals promoting conservation of resources have forced both the region and the state to make concerted efforts at developing other approaches to waste management, including reducing the amount of waste that goes into landfills. The costs for landfilling our garbage will continue to increase as local landfill space decreases near urban centers. These costs will eventually be passed on to residents and businesses in the form of higher disposal fees and eventually, in conspicuous impacts to public health and the environment.

Overflowing landfills are primarily a symptom of a bigger problem—mismanagement of our natural resources. The result of this mismanagement is evident in the mountains of garbage that we produce and the associated health and environmental impacts that result. For example, to obtain the resources used in the manufacturing and production of many of the goods that we use everyday, the mining industry moves an estimated 28 billion tons of soil and rocks each year (globally).[6] A 1999 study puts this figure at 48.9 billion tons when biomass extraction is included and 8.2 tons per capita average global resource consumption. When broken down by country, figures show that on a per capita level, extraction of raw materials increases with development status.[7]

The goods produced from these resources are usually single-use products that are meant to be replaced or thrown away. This leads to an inextricable link between our level of resource consumption, the waste we produce, and many environmental problems. Mining leaves behind a wake of destructive impacts including threatening local and global biological diversity through habitat destruction; increased chemical contamination, erosion, and silting of lakes and streams; and toxic air pollution containing arsenic and lead emissions.[8]

THE PLAN

This chapter identifies a combination of both short and long term solutions to effectively address our overwhelming waste problem. In the short term, we still need to rely heavily on landfills. In the long term, we need to change the way we think about trash and move towards a system of waste prevention and minimization. The move towards this system will take time and require a variety of waste management strategies, including development of conversion technology facilities capable of converting post-recycled residual waste material into useful products to help reduce our dependence on landfills. The goal is to achieve maximum waste prevention and diversion of waste

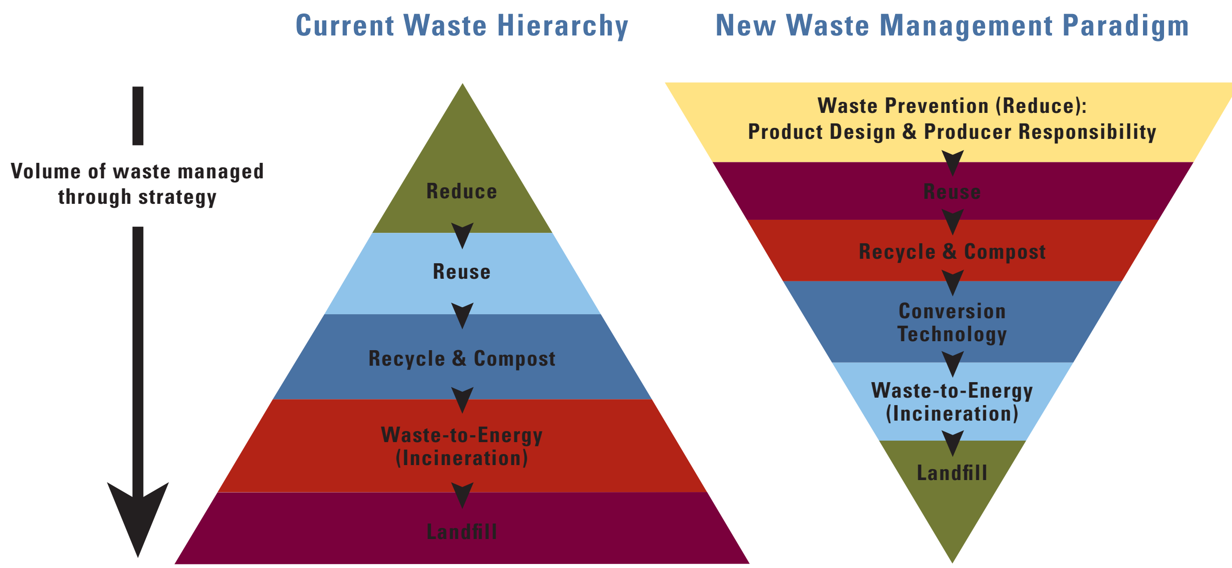
from landfills, with corresponding diversion credit, utilizing all technologically feasible and fiscally prudent means.

Strategies for Managing Our Waste

Landfills today are technically sophisticated, highly regulated, and closely monitored by many local and state agencies. Methane and leachate collection systems are installed in many facilities and state-of-the-art leachate[9] barriers (landfill liners) are required under current regulations. Some landfill operations in Southern California have methane capture technologies that turn methane emissions into energy. For example, the Puente Hills landfill currently produces 50 megawatts (gross) of power from landfill capture operations which it sells to Southern California Edison. One megawatt (one million watts) is enough to power up to 1000 average California households.[9b] Average landfill gas emissions are comprised of 50 percent methane (which is equivalent to about half the energy produced by combustion of natural gas).[10]

Landfills fill a critical need today and will continue to be needed well into the future. Even as we employ all waste prevention, recycling, reuse, composting, and conversion technology strate-

FIGURE 7.2
Envisioning a New Waste Management Paradigm



Source: SCAG

Despite our best efforts, there will always be inefficiencies

WHAT ARE LOCAL COMMUNITIES DOING?

Some forward thinking communities in the SCAG region are already implementing and adopting policies to increase their waste diversion goals and ensure a better quality of life for their local residents.

- City of Los Angeles: 70 percent diversion by 2020; 90 percent by 2025
- City of Santa Monica: 70 percent diversion by 2010
- City of Pasadena: No waste to landfills and incinerators by 2040
- 16 cities/townships in San Bernardino County have partnered to educate their residents and businesses on waste reduction, reuse and recycling*.

*as required by AB 939

gies, there will always be some inefficiencies in the system and therefore, waste that will need to be disposed at a landfill. The challenge will be to change our ideas of resource consumption and waste and to begin to think of disposal to landfills as the last resort in waste management. We must reduce our garbage volume and become more selective about what and how much we are willing to trash. Our current infrastructure to manage waste focuses on disposal first, followed by recycling, reducing, and reusing. The new waste hierarchy (first envisioned in 1989) focuses on reducing first, then reuse, recycling, conversion technologies and finally disposal to land fill (see **Figure 7.2**).

Shrinking local landfill capacity is also forcing us to transport waste to more distant landfills. A prime example of this is the planned waste-by-rail system being developed by the County Sanitation Districts of Los Angeles County. The system is designed to address the projected shortfall of disposal capacity in Los Angeles County by transporting post-recycled waste to an out-of-county landfill. The rail system will have multiple starting points at large-scale materials recovery facilities throughout Los Angeles County.[11] Existing rail lines will be used to transport the waste to Mesquite Regional Landfill, in Imperial County located approximately 35 miles east of Brawley. The 2,290 acre landfill is under construction and expected to be operational by 2012. It is permitted to accept up to 20,000 tons of waste per day (with up to 1,000 tons per day coming from Imperial County), and has a maximum capacity of 600 million tons of solid waste over a 100 year lifespan.[12, 13]

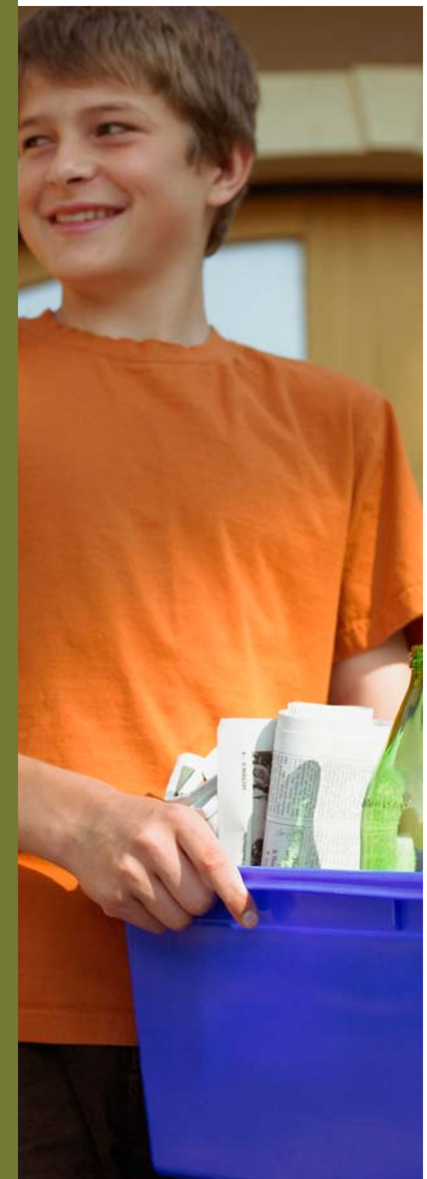
Due to potential air quality impact that may result from solid waste rail operations, it is expected that waste by rail operations will be consistent with strategies developed for the Air Quality Management Plan and the Regional Transportation Plan.

Although exporting waste is not a preferred waste management option, it is a necessary strategy for ensuring the County has a place to dispose of the garbage generated by County residents and businesses. Unlike other states, California does an excellent job of keeping solid waste within its borders. In the SCAG region, less than one percent of our waste is exported outside of the region.[14]

Diverting Garbage Away from Landfills

In 1989, the legislature passed the California Integrated Waste Management Act (AB 939).[15] This bill mandated a 50 percent solid waste diversion[16] rate by the year 2000 for all cities, counties, and applicable regional agencies in California, but did not include provisions for achieving the diversion rate. Under AB 939, local governments are responsible for preparing a diversion plan and instituting a financial mechanism to implement the plan.

Since then, Californians have done a great job in reducing the amount of waste sent to landfills. Although not all individual jurisdictions have managed to achieve the 50 percent diversion rate, jurisdictions are making good-faith efforts to comply with the unfunded mandate by implementing quality programs.



The estimated diversion rate for California in 2006 is 54 percent (our region's diversion rate is estimated at 50 percent). The California diversion rate translates to 50.1 million metric tons of waste (out of 92.2 million metric tons of waste generated) that avoided disposal to landfills.[17] Diversion is generally defined as the reduction or elimination of the amount of solid waste from solid waste disposal (to landfill or incineration). Thus far, only source reduction (waste prevention), reuse, recycling, and composting activities are considered diversion.

Economic Benefits of Diversion

Diversion activities create jobs, add local revenue, and help stimulate many economic sectors. Some employment opportunities created by these activities include government and private staffed collectors, recyclable material wholesalers, compost and miscellaneous organics producers, materials recovery facilities, glass container manufacturing plants, plastics converters, and retail used merchandise sales. A 2001 report from UC Berkeley stated that, "diverting solid waste has a significantly higher (positive) impact on the economy than disposing it." Diversion can help communities that do not have local landfill facilities save money by avoiding payment of tipping fees on each ton of waste disposed. The UC Berkeley study estimated that statewide economic impacts from disposal and diversion at 1999 rates were approximately 17 to 20 percent higher than the impacts if all the waste had been disposed (see **Table 7.1**).[18] This is because reuse and recycling are inherently value-adding,

TABLE 7.1 ECONOMIC IMPACTS OF 1999 WASTE GENERATION GOING TO DISPOSAL OR DISPOSAL AND DIVERSION

Region		Estimated Final Sales 1999 (billions of dollars)	Impact on Economy			
			Output[b] (billions of dollars)	Total Income[c] (billions of dollars)	Value Added[d] (billions of dollars)	Number of jobs created
All California	Disposal only	7.5	18.0	6.8	9.0	154, 000
	Disposal and Diversion	9.2	21.2	7.9	10.7	179,000
Southern California[a]	Disposal only	4.1	9.6	3.6	4.7	82,000
	Disposal and Diversion	5.1	11.3	4.2	5.6	95,000

Table adapted from Goldman, G. and A. Ogishi, 2001. The Economic Impact of Waste Disposal and Diversion in California. A Report to the California Integrated Waste Management Board.

[a] Southern California region includes all six SCAG region counties plus San Diego County.

[b] Output impact is a measure of how the disposal sectors influence total sector sales in the economy.

[c] Income impact measures income attributed to disposal-related economic sectors.

[d] Value added is the increase in the value of goods and services sold by all sectors of the economy.

Reuse and recycling prevent pollution that may be caused by

HOW SOLID WASTE POLICIES IMPACT OTHER RESOURCES

Land Use and Housing: The siting of new or expanded waste management facilities are often incompatible with existing or planned land uses in a community. As our waste decreases, the need for new waste management facilities will also decrease.

Open Space and Habitat: Materials extraction activities are intensely disruptive to wildlife and their natural habitats. Changing and reducing the waste stream will significantly reduce open space impacts by reducing the need for raw materials extraction and reducing the pressure to open new landfills.

Water: Litter, especially plastics, can end up in waterways and become a significant source of pollution. With less to throw away non-point source pollution impacts can be decreased. Additionally decreased reliance on landfills will reduce future risks of groundwater contamination from landfills as they age.

whereas disposal is not; and value-adding processes support jobs and economic activity.[19]

Reuse and Recycling

California hosts approximately 5300 recycling and reuse facilities, employing 84,000 people and generating an annual payroll of $2.2 billion with $14.2 billion in annual revenues.[20] However, California's local recycling market is still unstable and extremely susceptible to competition from foreign recycling markets. Many countries will pay a premium for our recyclables because they lack their own raw materials. In an effort to support the local recycling industry, the California Integrated Waste Management Board (CIWMB) has developed the Recycling Market Development Zone (RMDZ) program. The program provides loans, technical assistance, and free product marketing to businesses that use materials from the waste stream to manufacture their products.[21] Although this market development program is important, local governments have continually stressed the need for the State to take a leadership role in developing markets since our services and products are trading and competing on a global basis, and thus are susceptible to events/market fluctuations throughout the world. Based on the economic principle of supply and demand, recyclables will end up in landfills if markets are not developed or strengthened.

Source: California Integrated Waste Management Board. 2004. Statewide Waste Characterization Study. (Publication # 340-04-005)

There are numerous benefits to recycling and reuse programs. Reuse and recycling reduce the need for landfilling and prevent pollution that may be caused by the manufacturing, transportation, and use of products from virgin materials (see **Figure 7.3**). They help conserve natural resources (timber, water, minerals); sustain the environment for future generations; save energy and avoid fossil fuel use from extractive industries; decrease GHG emissions that contribute to global climate change; protect and expand U.S. manufacturing jobs; and increase U.S. competitiveness.[22]

A 1994 Tellus Institute study showed that with the exception of aggregate materials for road base, many materials show energy savings by using recycled materials instead of virgin materials. The range of differences in energy saved varies greatly. At the high end is aluminum -- it takes 142.68 MBtu (Million British Thermal Units)[*22b] per ton more to process aluminum from raw ore than it does to process the same product from recyclables. At the low end is molten glass for which the energy difference is only 1.54 MMBtu per ton of product.[23] A more recent life cycle assessment study from Alcoa (a leader in the production and management of primary aluminum) researchers has shown that it takes 95 percent less energy to recycle aluminum than to create it from raw materials.[24]

Construction and Demolition Debris

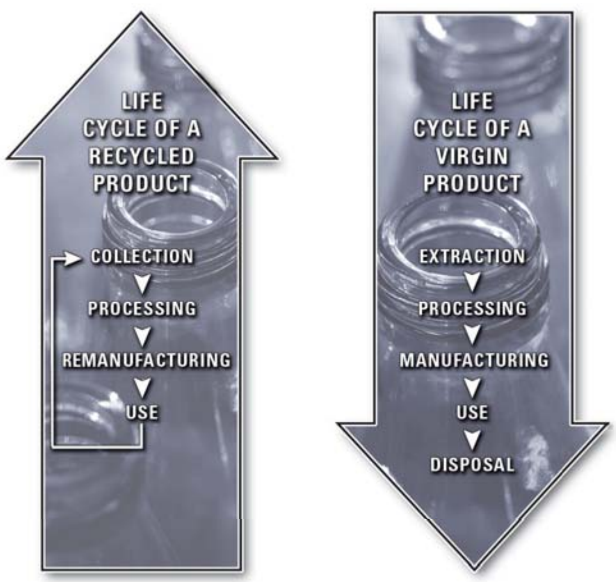
As of 2004, construction and demolition (C&D) debris comprised 21.7 percent of California's overall disposed waste *manufacturing, transportation, and other processes.*

stream. This equates to approximately 8.7 million tons of C&D debris disposed to landfill. Lumber debris makes up half of that figure, followed by concrete, asphalt roofing, gypsum board, and composite/remainder C&D.[25]

Addressing C&D waste prevention can be as simple as using best management practices during construction such as advanced framing, double checking measurements to reduce sizing mistakes, and using durable materials that need less frequent replacement.[26] It also means using green building design principles to maximize the use of remanufactured, recycled, or more efficient materials or materials that are designed to be replaced in a modular manner. Unlike demolition waste, up to 80 percent of construction waste is reusable or recyclable.[27] C&D diversion rates have reached as high as 97 percent on individual State of California projects, and are typically at least 50-75 percent in green buildings.[28]

FIGURE 7.3

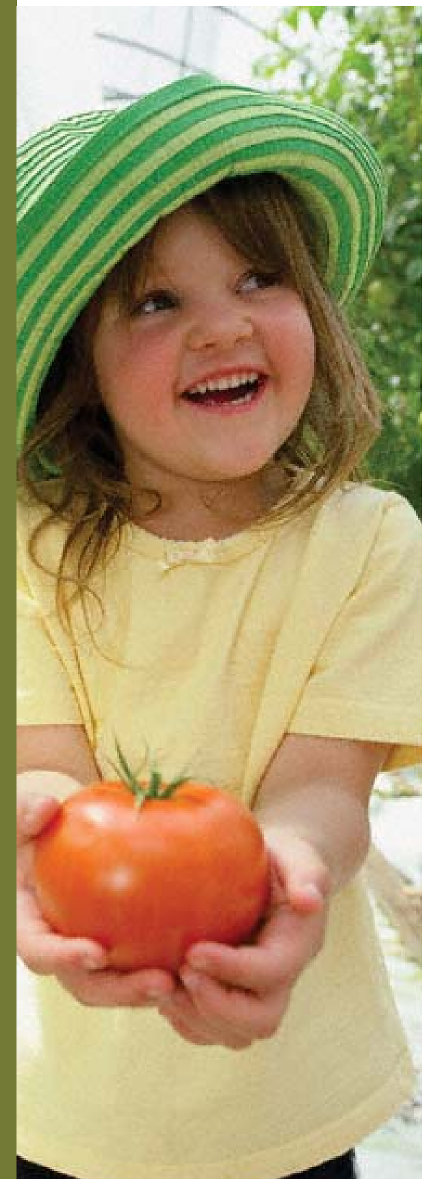
Comparing Life Cycles of a Recycled and Virgin Product



Source: Environmental Protection Agency. 1998. Puzzled About Recycling's Value? Look Beyond the Bin. EPA530-K-97-008. http://www.epa.gov/msw/recpubs.htm.

Cities and counties are starting to institute green building ordinances that require maximum recycling of C&D debris for many types of new construction. Uniform statewide requirements for green building or C&D recycling ordinances do not yet exist, although state legislation has been introduced to address this issue. Currently, each city or county develops its own ordinance: defining the size, cost, and type of project that is subject to C&D recycling as well as the amount of material recycling required.

The 2003 report to California's Sustainable Building Task Force provides a comprehensive and convincing study of the value of green building savings. It was found that although there were minimal increases of about 2 percent in up-front costs to add green building features, life cycle savings resulted in 20 percent of total construction costs—more than 10 times the initial investment. For example, an initial up-front investment of up to $100,000 to incorporate green building elements into a $5 million project would result in a savings of $1 million in today's dollars over the life of the building.[29]



The attraction of conversion technologies is their ability to

HOW SOLID WASTE POLICIES IMPACT OTHER RESOURCES

Energy: Recycling and waste prevention conserve energy. Making goods from recycled materials typically requires less energy than making goods from virgin materials. Waste prevention avoids energy used in the extraction, transport, and processing of raw materials to create new products.

Air Quality: Emissions from transport, manufacturing, production, and disposal and other waste management practices will be avoided through increased recycling, reuse, and waste prevention. Further, methane gas associated with new or expanded landfills can be reduced, with benefits for climate change and regional ozone planning efforts.

Transportation: As packaging waste is reduced, the need for vehicles to transport waste to disposal or recycling facilities should also be reduced.

Food Waste, Organics, and Composting

Californians throw away more than 5 million tons of food scraps each year. Food waste makes up 14 percent of California's waste stream. This includes all food being disposed by residences, businesses, schools, prisons, and other institutions. Green material collection programs have been implemented in many cities and counties, but not until recently have food scrap collection programs been more actively pursued. Management of food scraps provides additional opportunities to help meet the State's diversion goals as well as provide greater uses for this resource. The CIWMB suggests the following order for food scrap management: (1) prevent food waste, (2) feed people, (3) convert to animal feed and/or rendering, and (4) compost. Large events and venues, public facilities (e.g., public agency and school cafeterias), and private business such as restaurants and grocery stores could all be targeted for food waste diversion activities.[30]

Decomposition of food waste and other organics are a major source of greenhouse gas emissions from landfills. Organic waste comprises 30 percent of waste disposed to landfills. That figure includes food scraps, textiles, carpets, composite organics, and green material like landscape and tree trimmings, grass clippings, and agricultural residues.[30b] Diverting organic wastes to composting prevents the production of methane, which is produced during decomposition under anaerobic (oxygen-lacking) conditions such as those found in landfills. Composting has many environmental benefits. In addition to reducing landfill volume and emissions by diverting organic waste, compost can be used in the following ways: to enhance garden and agricultural soils, in wetland construction, as landfill cover, for erosion control, and in land/stream reclamation projects. Although there are environmental concerns associated with composting, primarily emissions and odor complaints, advancements in composting technologies and proper implementation of these technologies are able to help alleviate these concerns.

Conversion Technologies

Conversion technologies (CTs) refer to a diverse set of processes used to convert waste products into high-value goods such as industrial chemicals or gas, liquid, and solid fuels. Fuel products can be burned to produce energy or refined for higher quality uses to make a variety of industrial products.[31] The attraction of CTs is their ability to convert landfill waste into products that can take the place of fossil fuels mined from natural resources.

CTs target *post-recycled* municipal solid waste residuals currently destined for disposal at landfills as their feedstock (i.e., source of raw materials). That is, recyclables are removed and collected before waste is sent to a CT facility. Many CT proponents state that CTs with recycling offer a much better alternative than incineration or disposal to landfill. CTs also have the capability of recovering additional recyclable materials, especially metals and glass that might otherwise not be feasibly recoverable since CTs operate better when recyclables are extracted prior to the conversion process.

A study conducted for CIWMB compared a life cycle analysis of landfills (with various stages of landfill gas collection), waste to energy (WTE) combustion (incineration), and hypothetical conversion technologies. It was found that the hypothetical CT scenario could potentially have a two times lower net energy consumption when compared to the incineration scenario and up to 11 times lower than landfill without energy recovery. The CT scenario included energy savings (10-20 percent of the total net energy savings) from additional materials recycling prior to conversion and the offsets associated with the prevention of extraction and production of virgin materials.[32] However, the environmental benefits of conversion technology scenarios are highly dependent on their ability to achieve high conversion efficiencies and high materials recycling rates.

At the present time, conversion technologies are considered ineligible as a diversion strategy under AB939 and the permitting and siting of CT facilities has been met with some opposition. CT opponents cite the currently impractical cost of CTs as well as the potential for CTs to compete with recycling (i.e., papers and plastics that could be recycled end up in a CT facility instead). Conversion technologies have been around for decades, but it is only recently that their applicability to solid waste management has begun to be fully developed. At this time, the successful development and use of CTs is occurring throughout Europe and Japan.

Three main categories of conversion technologies are being developed for management of solid waste - thermal, chemical, and biological conversion.

- Thermal (thermochemical) conversion is characterized by high temperatures processes to achieve high conversion rates of dry, organic material (such as plastics). These processes include gasification, pyrolysis, plasma arc, and catalytic cracking. Advanced thermal conversion primarily refer to technologies that employ only pyrolysis and/or gasification to process municipal solid waste.[33] The primary products of thermochemical conversion technologies include: fuel gas (syngas - CO_2, CO, CH_4, H_2), heat, liquid fuel, char, and ash.[34]

- Biological (biochemical) conversion processes rely on microorganisms to break down the biogenic, organic fraction of the waste stream. These processes focus on the conversion of biodegradable organics found in MSW residue into high energy products. The products of bioconversion are biogas (CH_4 and CO_2), biofuel (ethanol, biodiesel, fuel oil, etc.), and residue that can be used for compost. Biogas usually has less energy (Btu/ft^3) than syngas produced by thermal conversion systems.[35] Non-biodegradable organic feedstocks, such as most plastics, are not convertible by biochemical processes.

- Chemical (physicochemical) conversion processes use lower temperatures and reaction rates than thermal conversion. These processes rely on chemical reactions and

We need to address waste elimination at the source and let

HOW SOLID WASTE POLICIES IMPACT OTHER RESOURCES

Environmental Justice: Landfills and other solid waste management facilities tend to be built in areas that see them as a boost to their local economy. These areas tend to be in poor or minority neighborhoods. Reducing the need for new or expanded facilities could reduce their disproportionate impact on disadvantaged communities.

Climate Change: While capturing methane gas at landfills is increasingly common for conversion into valuable energy, reducing the amount of waste deposited into landfills reduces the need to build and expand landfills, which account for 1/3 of California's methane emissions. Methane is a very potent greenhouse gas that has 21 times more global warming potential than carbon dioxide.

focus on the conversion of organic wastes into high energy products. Processes, such as acid hyrolysis, thermal depolymerization, and fermentation typically focus on generating fuels such as ethanol or biodiesel.

Maximizing Diversion - A New Paradigm

In the last 10-15 years there has been a strong movement to acknowledge the link between the waste we generate and the natural resources we consume. Waste is a reflection of today's economy, based on the extraction of "cheap" resources to make products that are largely designed to end up in landfills. SCAG's 2004 Growth Vision recognized this and stated that "management of solid waste (and hazardous waste) must be sustainable in order to efficiently manage natural resources and in order to protect the environment today and in the future."

A new paradigm is taking shape that builds on all the waste diversion strategies that were previously discussed. Although the three Rs of solid waste management – Reduce, Reuse, Recycle – still hold true, a renewed emphasis on the first R is taking hold. We need to go beyond current waste diversion strategies by addressing waste elimination at the source and encouraging legislation requiring manufacturers to reduce waste. This will distribute the responsibility for waste on not just the consumer, but the producer as well. Instead of managing just the end results of our consumption-related activities (trash), we focus on resource conservation and management. The aim is to create a whole system approach to the way materials flow through society, where all discarded materials are resources for others to use and resource conservation and recovery is built into every process. It means designing and managing products and processes to reduce impacts to the environment, volume and toxicity of waste and materials, and waste of natural resources, as well as managing materials flow to prevent the creation of un-recyclable products. We may "never achieve 100 percent materials efficiency but, we can get darn close!"[38]

Strategies to maximize diversion look at the entire product life cycle to assess the true economic, environmental, and health-related costs of manufacturing products. Life cycle assessments[39] (LCAs) attempt to appraise all the inputs and outputs that are associated with the creation and disposal of a product such as, associated wastes and emissions of the manufacturing process and the future fate of the product. Using aluminum recycling and production as an example, downstream effects that should be analyzed would include the energy consumption and emissions of smelters used to melt the raw ore versus recyclable cans and the ultimate fate and use of the product. In some cases, recyclables that have been locally collected are exported for use overseas.

LCAs and similar applications can identify deficiencies in a process and help compare the benefits and costs of multiple systems. By evaluating the existing materials flowing through a community, we can identify opportunities to take one business's byproduct or waste and provide that material to another business to uset as a source of raw material in their manufacuring process. In addition, an LCA that compares recycling systems with other waste management strategies (such as disposal at landfills or disposal at conversion technology facilities) would provide useful information for basing future waste management decisions. Such an LCA for California's waste management system would be a useful tool for local policymakers.

Promoting these types of strategies is good regional policy as existing businesses can save money by creating efficiencies in production and government agencies and other organizations have better analytical tools for making important decisions.[40] CIWMB currently runs a free materials exchange service, the California Materials Exchange (CalMAX) program, that helps businesses, organizations, and individuals find markets for materials that would otherwise be discarded.

Product Stewardship and Extended Producer Responsibility

This new paradigm requires that we change the current solid waste management hierarchy to one that focuses on product stewardship and extended producer responsibility principles because one of the most effective ways to manage waste is to prevent it from being produced in the first place.

Product stewardship is a product-centered approach to environmental protection. It extends the responsibility for a product to everyone involved in the product lifecycle. This means that manufacturers and producers design products that are recyclable, reusable, less toxic, less wasteful, and/or more durable. It also means getting rid of excessive packaging such as the cardboard box that encloses a plastic medicine bottle. Retailers and consumers are then responsible for ensuring that proper recycling and disposal of products occur.

Product stewardship is often used interchangeably with Extended Producer Responsibility (EPR). However, EPR focuses the brunt of the responsibility for creating an environmentally compatible product on the manufacturers and producers of the product. Producers retain responsibility for their end-of-life products. This provides them with incentives for designing products for recycling, reuse and easy dismantling.[41] For example, businesses making products that are leased, such as Hewlett-Packard have long known that their products will be returned so they have learned to make remanufacturing profitable. When businesses are compelled to internalize the true costs of wasteful packaging and inefficient material use, there is incentive to create more innovative and efficient waste management strategies.

EPR policies should give producers an incentive to design products that:

- Use fewer natural resources;
- Use greater amounts of recycled materials in manufacturing;
- Can be reused;

LIFE CYCLE ASSESSMENTS

Life Cycle Assessments (LCAs) need not be limited to analyzing the life cycle of a single product. LCA is a methodology that can analyze the interactions of a technological system with the environment. It can be used as a decision-making tool to help weigh environmental and health impacts between various waste management options. If used correctly,[36] LCAs can answer questions like, "Are impacts from manufacturing aluminum cans from raw material really much worse than the impacts from re-manufacturing of recycled aluminum and if so, how much worse?" and "Have the costs of environmental and health impacts, such as losing ecosystem services10 and the loss of worker days been calculated into the costs?" Governments, private firms, consumer organizations, and environmental groups can all use LCA as a decision support tool.[37]

- Can be more easily treated/dismantled and recycled; and
- Reduce or eliminate the use of hazardous substances or materials in the manufacturing of products.

The EPR approach should be seen as a system for preventive environmental policy-making. EPR promotes a sustainable approach to resource use and reduces the quantity of solid waste going to a landfill, by diverting end of life products to re-using, recycling, or other forms of recovery. Many corporations are recognizing the value of EPR and have developed voluntary EPR strategies in their organizations. However for EPR to be truly effective, legislation requiring the implementation of EPR practices will need to be instituted at the state and preferably, federal levels.

The Solid Waste Action Plan

The strategies described in this chapter are meant to provide background for implementing the action plan that follows. The goal is to create a vision for solid waste and resource management that will move our region toward a more sustainable and healthier future through a coordinated effort of implementing all of the short-term and long-term actions contained within this plan. Some of these actions will require changing the way our region thinks about solid waste management issues.

Future success in effective resource management will require a creative mix of proven, cost-effective strategies to satisfy anticipated waste disposal needs. Recycling, composting, conversion technologies, and landfills all play a part in moving towards maximizing diversion.

SOLID WASTE GOALS

- A region that conserves our natural resources, reduces our reliance on landfills, and creates new economic opportunities in the most environmentally responsible manner possible.

SOLID WASTE OUTCOMES

- All SCAG region jurisdictions should meet a 40 percent waste disposal rate[42] by 2035 to minimize disposal to landfills provided appropriate utilization of technologies are permitted and diversion credit is provided by the State for waste management strategies including, but not limited to, appropriate and environmentally sound recycling, composting, and conversion technologies with diversion credit as well as other actions and strategies contained in this chapter, such as product stewardship and extended producer responsibility.
- Conversion and other alternative technologies should be available as a diversion strategy in the next five years with one or more new conversion technology facilities sited in the SCAG region by 2020.

SOLID WASTE ACTION PLAN

Best Practices	Legislation	Coordination	Constrained Policies	Land Use	Transportation	Air Quality	Water	Energy	Open Space	Economy	Security	Public Health	Climate Change
				Potential for Direct/Indirect Benefits								Other Benefits	
SCAG Best Practices													
		X	SW-1 SCAG should encourage all levels of government to advocate for source reduction and waste prevention.			X	X	X		X		X	
X		X	SW-2 SCAG should encourage policies that: (a) promote expansion of recycling programs and facilities that provide local recycling services to public and private sectors and (b) encourage development of viable, local, and sustainable markets to divert materials from landfills.			X	X	X		X			X
X			SW-3 SCAG should adopt and implement a recycled content procurement program and participate in programs that promote the purchase of recycled content products			X	X	X		X			X
		X	SW-4 SCAG should support and encourage the CIWMB to conduct comprehensive life cycle assessments of all components of the waste management practices including but not limited to, waste disposal to landfills, composting, recycling, and conversion technologies. A comprehensive analysis must include environmental impacts, health effects, emissions, use of resources and personnel, costs of same to collect wastes and recyclables, transportation costs (local, within U.S. or international), processes to separate recyclables, and production of end products using collected recyclables and raw materials.			X	X	X					X
	X		SW-5 SCAG should continue to support and encourage legislation that advocates for the elimination of unnecessary duplication and/or restrictive regulations that hinder recycling, reuse, composting and conversion of solid waste and redefines conversion technologies as a diversion strategy to allow development of these facilities in the SCAG region.			X	X	X		X			X
		X	SW-6 SCAG should coordinate source reduction, reuse, recycling, composting, and conversion technology efforts to increase economies of scale.			X	X	X		X			X
		X	SW-7 SCAG should encourage the equal distribution of industrial impacts among all income levels from all types of solid waste management facilities including recycling, composting, and conversion technology facilities.	X		X	X	X		X			X
		X	SW-8 SCAG should support the development of public education and outreach efforts to increase awareness of the benefits of a regional policy to maximize diversion.			X	X	X		X			X
Voluntary Local Government Best Practices													
X			SW-9 Local governments should update general plans to reflect solid waste sustainability issues such as waste reduction goals and programs (1996 RCP; 135).	X		X	X	X	X				X
X			SW-10 Local governments should discourage the siting of new landfills unless all other waste reduction and prevention actions have been fully explored. If landfill siting or expansion is necessary, landfills should be sited with an adequate landfill-owned, undeveloped land buffer to minimize the potential adverse impacts of the landfill in neighboring communities.	X		X	X	X	X	X			X

Best Practices	Legislation	Coordination	Constrained Policies	Potential for Direct/Indirect Benefits: Land Use	Transportation	Air Quality	Water	Energy	Open Space	Economy	Security	Other Benefits: Public Health	Climate Change
X			SW-11 Local governments should discourage exporting of locally generated municipal solid waste (destined for landfills) outside of the SCAG region. Disposal within the county where the waste originates should be encouraged as much as possible, when appropriate. Green technologies for long-distance transport of waste (e.g., clean engines, clean locomotives or electric rail for waste-by-rail disposal systems) and consistency with AQMP and RTP policies should be required.	X	X	X	X	X	X	X		X	X
X			SW-12 Local governments should maximize waste diversion goals and practices and look for opportunities for voluntary actions to exceed the 50% waste diversion target.			X	X	X		X			X
X			SW-13 Local governments should build local markets for waste prevention, reduction, and recycling practices.			X	X	X		X			X
X	X		SW-14. Developers and local governments should integrate green building measures into project design and zoning including, but not limited to, those identified in the U.S. Green Building Council's Leadership in Energy and Environmental Design, Energy Star Homes, Green Point Rated Homes, and the California Green Builder Program. Construction reduction measures to be explored for new and remodeled buildings include: • Reuse and minimization of construction and demolition (C&D) debris and diversion of C&D waste from landfills to recycling facilities. • An ordinance that requires the inclusion of a waste management plan that promotes maximum C&D diversion. • Source reduction through (1) use of building materials that are more durable and easier to repair and maintain, (2) design to generate less scrap material through dimensional planning, (3) increased recycled content, (4) use of reclaimed building materials, and (5) use of structural materials in a dual role as finish material (e.g. stained concrete flooring, unfinished ceilings, etc.). • Reuse of existing building structure and shell in renovation projects. Building lifetime waste reduction measures that should be explored for new and remodeled buildings include: • Development of indoor recycling program and space. • Design for deconstruction. • Design for flexibility through use of moveable walls, raised floors, modular furniture, moveable task lighting and other reusable components.	X		X	X	X	X	X			X
X	X		SW-15 Local governments should develop ordinances that promote waste prevention and recycling such as: requiring waste prevention and recycling efforts at all large events and venues; implementing recycled content procurement programs; and instituting ordinances to divert food waste away from landfills and toward food banks and composting facilities.			X	X	X		X			X
X			SW-16 Local governments should support environmentally friendly alternative waste management strategies such as composting, recycling, and conversion technologies.			X	X	X		X			X
X			SW-17 Developers and local governments should develop and site composting, recycling, and conversion technology facilities that are environmentally friendly and have minimum environmental and health impacts.	X		X	X	X					X
X		X	SW-18 Developers and local governments should coordinate regional approaches and strategic siting of waste management facilities.	X		X	X	X					X

Best Practices	Legislation	Coordination	Constrained Policies	Potential for Direct/Indirect Benefits								Other Benefits	
				Land Use	Transportation	Air Quality	Water	Energy	Open Space	Economy	Security	Public Health	Climate Change
X			SW-19 Developers and local governments should facilitate the creation of synergistic linkages between community businesses and the development of eco-industrial parks and materials exchange centers where one entity's waste stream becomes another entity's raw material by making priority funding available for projects that involve co-location of facilities.	X		X	X	X					X
X			SW-20 Developers and local governments should prioritize siting of new solid waste management facilities including recycling, composting, and conversion technology facilities near existing waste management or material recovery facilities.	X		X	X	X					X
X			SW-21 Local governments should increase education programs to increase public awareness of reuse, recycling, composting, and green building benefits and raise consumer education issues at the County and City level and if appropriate, at local school districts and education facilities.			X	X	X		X			X
State and Federal Government Strategies													
	X		SW-22 CIWMB should create waste diversion incentives to increase waste diversion past 50% including credit for conversion technology.			X	X	X		X			X
	X		SW-23 Federal and State governments should develop and implement new and existing legislation that requires recycled content procurement programs, favoring the purchase of recycled and recyclable products or products with built-in EPR design in all state and federal agencies.			X	X	X		X			X
	X		SW-24 Federal and State governments should explore financial incentives such as tax credits, subsidies, and price supports for waste diversion activities that include waste reduction, recycling, composting, and conversion technologies.			X	X	X		X			X
	X	X	SW-25 CIWMB, Air Resources Board, and the California Water Resources Board should coordinate to address regulatory challenges and streamline the permitting process for solid waste conversion and composting technologies.			X	X	X					X
	X		SW-26 The federal government and CIWMB should establish policies that provide (a) diversion credit for beneficial use of post-recycled, solid waste residuals managed at non-burn conversion technology facilities, and (b) separate and remove conversion technologies from the "transformation" definition.			X	X	X	X			X	X
	X		SW-27 Federal, State, and local governments should support and encourage federal and state incentives for the research and development of pilot or demonstration projects for solid waste conversion technologies.			X	X	X	X				X
		X	SW-28 CIWMB should do the following to improve education and awareness of solid waste management issues: (a) actively promote education regarding reuse, recycling, composting and solid waste conversion technology programs; (b) provide information concerning the costs and benefits of these programs to local governments; and (c) facilitate state and local government coordination of consumer awareness programs to minimize unnecessary duplication of effort in solid waste outreach programs carried out by local government.			X	X	X	X	X			X
	X		SW-29 The Federal government should provide funding and support for continuation of waste management public education programs.			X	X	X	X	X			X
	X	X	SW-30 The CIWMB should take a more active leadership role in developing recycling markets since our local services and products are trading and competing on a global basis and thus are susceptible to events/market fluctuations throughout the world.			X	X	X	X	X			X

				Potential for Direct/Indirect Benefits								Other Benefits	
Best Practices	Legislation	Coordination	Strategic Initiatives	Land Use	Transportation	Air Quality	Water	Energy	Open Space	Economy	Security	Public Health	Climate Change
State and Federal Government Initiatives													
	X		SW-1S Federal, State and local governments should support and implement source reduction policies which promote product stewardship through the following actions: • Create incentives for participation in Product Stewardship and Extended Producer Responsibility (EPR) initiatives such as, encouraging public-private partnerships with product stewardship goals (e.g. The European Green Dot system) and offering incentives to producers who use recycled content to encourage growth in the recycled contents market. • Create ordinances with EPR policies that require producers and manufacturers to produce "sustainable" packaging and products, develop life cycle assessments for products, as well as, support the development of infrastructure and markets for the recycling and reuse of these products. EPR principles that should be included are: increasing the useful life of products through durability and reparability; increasing production efficiency to produce less production waste and less packaging waste; increasing recyclable material content and reducing virgin material content; facilitating material or product reuse; and decreasing of the toxicity of products. Packaging should be easily recyclable or biodegradable based on any number of EPR strategies including, Design for the Environment or Design for Disassembly principles. For example, businesses such as, takeout food distributors, should utilize packaging that is compatible with recycling and composting options available.		X	X	X	X	X	X		X	X
	X		SW-2S Federal, State and local governments should create tax incentives that help companies derive profit from resource efficiency. Actions such as the following would be included: • Institute Pay As You Throw solid waste disposal systems, where customers are charged for disposal services based on the amount thrown away. • Require that companies take back certain types of packaging for reuse or recycling:		X	X	X	X	X	X		X	X

Footnotes

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[15] Public Resources Code (PRC), Section 41780.

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